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Recommendation for the inclusion of a fast, cost-efficient geophysical tool for contaminant delineation to aid in the cleanup efforts of the Willamette Superfund zone.

Among the contaminants of concern within the 10-mile long EPA Willamette Superfund zone are hydrocarbons, dioxins, PCBs, and heavy metals (e.g. Arsenic, Cadmium, Chromium and Mercury). An important piece of the clean-up effort is the delineation of the contaminants before, during, and after remediation. Traditional methods of sediment contaminant delineation often include a significant field effort and lab costs for each survey.

The use of a geophysical method referred to as Induced Polarization allows for an economical, fast, and non-invasive approach for delineation of targeted contaminants. The method can provide a 3D data volume which can be effectively used in all stages of the clean-up effort to:

- (1) generate a detailed model to aid in the planning stages of the cleanup operation
- (2) periodically monitor and measure progress during active stages of cleanup operations
- (3) give EPA a verifiable proof of success with respect to completion of cleanup

Induced Polarization Associates (IPA) has been conducting trials to delineate specific contaminants in the sediment, using USGS-patented Marine Induced Polarization (IP) technology. Results have thus far correlate with lab tests. Measurements can be taken using a small vessel (23-foot minimum) and a two-person survey crew, which enables simplified field operations and flexible response times. The system can provide independent survey results for verification of the presence or absence of contamination, with minimal disturbance of the substrate and fast turnaround of data prior to or during dredging and capping activities.

IP surveys have been successfully conducted in a river environment as well as in open ocean. The river survey was carried out to investigate sequences of toxic mine tailings that have settled in the bed of the Coeur d'Alene River, Idaho. The IP data showed a zone of high chargeability that was attributed to pockets of relatively higher metal content. The open ocean survey successfully detected and delineated ilmenite deposits off the coast of Africa.

To conduct an IP survey, initial site sampling is required to support pre-survey laboratory calibrations of the equipment, and then a baseline survey is conducted. For the pre-survey laboratory calibrations, an Induced Polarization spectral signature library is built based on assayed samples from the site,

potentially using samples that are already part of the site study, and detectable thresholds are determined. The laboratory characterization results are then used to optimize field and processing parameters. For the baseline survey, an initial field survey is performed to identify target areas of interest, and then a location-specific, full broad-band spectral IP survey over an identified target is conducted.

Measurements included CTD casts and IP profiles, and may include current measurements and grab/core samples if existing samples are unavailable.

Deliverables would include a 3D data set, with 2D plan view and vertical slice heat maps of concentrations of targets. A coring program is used to ground truth the 3D site map and to test for toxic focus group concentrations, likely conducted as part of traditional delineation efforts.

Data turnaround times for initial results are fast, however the full spectral analysis that would be performed for during the first survey requires more time.

Recommendation

It is recommended that an initial IP survey is conducted as a baseline, during which the system would be calibrated for the site. Ongoing monitoring of the site can be conducted to document progress, and then a post survey conducted to verify the absence of contamination. The survey operations and general survey plan are determined in consultation with the client. A possible option is to investigate the use of IP monitoring of suspended contaminants in the river water column, which may be disturbed by the cleanup efforts. Background measurements should be collected prior to the active start of cleanup operations. The monitoring station would be portable and downstream of cleanup activities, and the location based on the current profile and associated transport models.